This Page Is Inserted by IFW Operations
and is not a part of the Official Record

BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images may include (but are not limited to):

- BLACK BORDERS
- TEXT CUT OFF AT TOP, BOTTOM OR SIDES
- FADED TEXT
- ILLEGIBLE TEXT
- SKEWED/SLANTED IMAGES
- COLORED PHOTOS
- BLACK OR VERY BLACK AND WHITE DARK PHOTOS
- GRAY SCALE DOCUMENTS

IMAGES ARE BEST AVAILABLE COPY.

As rescanning documents *will not* correct images, please do not report the images to the Image Problem Mailbox.

RES[illegible]

PATENT SPECIFICATION 741,831

Date of filing Complete Specification: May 3, 1954.

Application Date: Feb. 3, 1953. *No.* 3039/53.

Complete Specification Published: Dec. 14, 1955.

Index at Acceptance:—**Classes** 7(2), B(2A2D : 5Q2) ; and 7(6), B2P2(B : I : K4).

COMPLETE SPECIFICATION.

An Improved Operating Mechanism for Lift Valves.

We, KELSTON ENGINEERING COMPANY LIMITED, a Company organised under the laws of Great Britain and Northern Ireland, and GEORGE WASHINGTON BURRAGE, a British Subject, all formerly of 160 Lawrence Hill, Bristol 5, and now of Kitchener Road, Lodge Causeway, Fishponds, Bristol, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:

This invention relates to an operating mechanism for lift valves.

The object of this invention is to provide an improvement in positively opened and closed lift valves and is particularly applicable to the poppet valves of high speed internal combustion engines.

According to this invention we provide an operating mechanism for a lift valve having a closure member at the end of a stem, wherein the mechanism comprises a sleeve mounted for axial sliding motion on the stem, a first abutment on the stem to be abutted when the valve is to be opened, by the end of the sleeve nearest the closure member, a helical compression spring situated around the stem between the other end of the sleeve and a second abutment on the stem for the sleeve to act on the second abutment through the intermediary of the spring when the valve is to be closed, a cam having the form of a groove in the end face of a cam member whose axis of rotation extends in a direction at right angles to the stem, and a cam follower arrangement connecting the cam to the sleeve for the operation of the valve.

The cam follower arrangement may comprise a cam follower situated in said groove and connected directly to the sleeve. Alternatively the cam follower arrangement may comprise a cam follower situated in the groove and acting on the sleeve through the intermediary of a lever.

The mechanism according to this invention absorbs only a fraction of the power needed for the operation of the conventional spring-returned valve; it is silent in operation; the resilient means compensate for any dimensional changes due to heat or minor inaccuracies in manufacture; and, for the period during which the valve is closed, the valve member is urged onto its seating through the intermediary of the said resilient means so that good closing conditions are maintained.

One form of this invention will now be described with reference to the accompanying drawings wherein:—

Fig. 1 is a part-sectional elevation of an operating mechanism for a poppet valve in a four-stroke internal combustion engine;

Fig. 2 is an enlarged section on the line II—II in Fig. 1; and

Fig. 3 is a section on the line III—III in in Fig. 2.

Referring to the drawings, there is provided a cylinder head 1 embodying a housing 2 enclosing a cam member or disc 3 mounted for rotation on a stationary pin 4, the disc circumference being provided with gear teeth for the disc to be driven by appropriate gearing (not illustrated). One end face of the disc is provided with an eccentric parallel-sided groove 5, that side of the groove which is nearer the centre of the disc constituting a cam *5a* while the other side of the groove constitutes a cam *5b*. The grooved end face of the disc 3 is completely free and has extending thereacross the stem 6 of a poppet valve 7, the position of the stem being such that its centre line intersects the axis of rotation of the disc 3 at right angles. A sleeve 8 is situated for free sliding motion on the stem 6 and constitutes a lost motion member.

Two abutments, a lifting abutment and a return abutment, are provided on the stem 6. The lifting abutment comprises a washer 9 provided with a slot 10 so dimensioned as to permit the washer 9 to be assembled on a neck 11 of the stem. The return abutment comprises a shoulder 12 of a sleeve 13 assembled on the stem 6 between the sleeve 8 and a split bush 14 the semi-cylindrical halves of which are assembled on a neck 15 of the stem 6. A compression spring 16 is situated between the shoulder 12 and the sleeve 8 and urges the latter towards the washer 9. A third abutment 27 is formed by the bottom end of the sleeve 13. The abutment 27 has a clearance 26 with the sleeve 8 and the abutment 27 becomes operative, i.e. the clearance 26 is closed, if at the end of the lifting stroke or at the beginning of the return stroke the inertia of the poppet valve 7 should tend to cause an undue compression of the spring 16. The sleeve 8 has formed thereon a pin 17 which extends parallel to the axis of the disc 3 and into the groove 5 and which has pivotally seated thereon a cam follower 18 adapted to slide in the groove 5 in working contact with the cams 5*a* and 5*b*. The follower 18 is so shaped that a face 19 thereof, being the face in contact with the cam 5*b* has a curvature equal to the most acutely curved part thereof, this being, in this example, between the points 20 and 21. This enables the follower 18 to make area contact with the cam 5*b* in a position of the working cycle when the pressure on the follower is high and thus good wearing conditions are provided for the follower and the cam. The housing 2 is provided with a cover 22 facing the grooved side of the disc 3, said cover 22 embodying two lugs 23, 23 forming between them a straight groove 24 embracing the exterior of the sleeve 8 for the latter to slide therein and be supported against the transverse forces imparted to it by the cams when in operation. The stem 6 is supported for axial sliding motion in a bush 28. The disc 3 is geared to the crank shaft of the engine in accordance with usual practice.

In operation, rotation of the disc 3 causes the poppet valve 7 to open and close. The cams 5*a* and 5*b* are so dimensioned that return stroke imparted by them to the sleeve 8 is slightly longer than the return stroke of the poppet valve 7, the return stroke of the latter being limited by its valve seating. Therefore, on completion of the return stroke, this being the position shown in the drawings, the sleeve 8 is lifted away from the washer 9 and forms a clearance 25 therewith, and a clearance 26 between the bottom end of the sleeve 13 and the sleeve 8 ensures that there is no solid connection between the sleeves 8 and 13. Upon commencement of the lifting stroke of the poppet valve 7, the clearance 25 is closed and the clearance 26 increased. Upon completion of the lifting stroke the inertia of the poppet is absorbed by the spring 16, the movement of the poppet valve 7 being finally limited by the clearance 26 closing and the sleeve 13 abutting the sleeve 8. This latter condition may arise upon commencement of the return stroke at high engine speeds.

The arrangement described is particularly suitable for small valves expected to operate at high speeds. The manner of assembling the lifting and the return abutments ensures the maximum strength for the stem and great safety in operation.

In a modification, a double-ended lever or rocker is interposed between the disc and the sleeve, one end of the rocker supporting the cam follower, while the other end of the rocker engages the sleeve. This arrangement does not require the grooved face of the disc to be entirely free, and the cam shaft may extend right through the disc. This enables a plurality of cam discs to be mounted on a common cam shaft such as would be desirable, for example, for an engine having two or more parallel cylinders situated in a common plane.

What we claim is:—

1. Operating mechanism for a lift valve having a closure member at the end of a stem, wherein the mechanism comprises a sleeve mounted for axial sliding motion on the stem, a first abutment on the stem to be abutted when the valve is to be opened by the end of the sleeve nearest the closure member a helical compression spring situated around the stem between the other end of the sleeve and a second abutment on the stem for the sleeve to act on the second abutment through the intermediary of the spring when the valve is to be closed, a cam having the form of a groove in the end face of a cam member whose axis of rotation extends in a direction at right angles to the stem, and a cam follower arrangement connecting the cam to the sleeve for the operation of the valve.

2. Mechanism according to Claim 1, wherein the axis of the cam substantially intersects the axis of the stem, and wherein the cam follower arrangement comprises a cam follower situated in said groove and in direct connection with the sleeve.

3. Mechanism according to Claims 1 or 2, wherein the cam follower arrangement comprises a cam follower having the form of a pivotal slide situated in the groove, and wherein the surface of the slide in contact with the side of the groove forming an internal cam has a curvature substantially equal to the smallest radius of said internal cam.

4. Mechanism according to any one of

the preceding claims, wherein there is provided on the stem a third abutment to be abutted by the sleeve if the spring is compressed beyond a pre-determined amount.

5. Mechanism according to Claim 4, wherein the third abutment comprises a tubular extension of the second abutment, the extension being situated on the stem and inside the spring.

6. Operating mechanism for a lift valve constructed, adapted and arranged substantially as described herein.

7. Operating mechanism for a lift valve constructed, adapted and arranged substantially as described herein with reference to the accompanying drawings.

MEWBURN, ELLIS & CO.,
70-72 Chancery Lane, London, W.C.2,
Chartered Patent Agents.

PROVISIONAL SPECIFICATION.

An Improved Operating Mechanism for Lift Valves.

We, KELSTON ENGINEERING COMPANY LIMITED, a Company organised under the laws of Great Britain and Northern Ireland, and GEORGE WASHINGTON BURRAGE, a British Subject, both of 160 Lawrence Hill, Bristol 5, do hereby declare this invention to be described in the following statement:

This invention relates to an operating mechanism for lift valves.

The invention is particularly applicable to the poppet valves of high speed internal combustion engines. Conventionally the valves of such engines are opened by cams and closed by springs, which has the disadvantage that at high speeds the poppet tends not to return at the rate permitted by the fall of its associated cam and eventually hits the valve seating with a noticeable noise. The stronger springs, normally introduced to overcome this difficulty, reduce the efficiency of the engine.

According to this invention an operating mechanism for a lift valve comprises cam means adapted to lift and return the valve member and to act upon the valve member through the intermediary of resilient means at least for the period during which the valve is closed, lost motion means being provided between the cam means and the valve member whereby the cam means may move independently of the valve member and deflect the said resilient means at least for the period during which the valve is closed.

Preferably, according to this invention, the cam means act upon the valve member through the intermediary of a lost motion member which, during the return period, acts upon the valve member through the intermediary of a spring, and wherein the return stroke imparted by the cam means to the lost motion member is longer than the possible return stroke of the valve member.

The cam means may act directly upon a cam follower attached to the lost motion member. Alternatively, the cam means may act upon the lost motion member through the intermediary of a lever.

The mechanism according to this invention absorbs only a fraction of the power needed for the operation of the conventional spring-returned valve; it is silent in operation; the resilient means compensate for any dimensional changes due to heat or minor inaccuracies in manufacture; and, for the period during which the valve is closed, the valve member is urged onto its seating through the intermediary of the said resilient means so that good closing conditions are maintained.

One form of the invention will now be described with reference to the valves in the cylinder head of a four-stroke internal combustion engine. Referring to one of the valves the said cam means comprise a disc, one end face of which is provided with an eccentric parallel-sided groove. That side of the groove which is nearer the centre of the disc constitutes an external cam while the other side of the groove constitutes an internal cam. The disc is secured to a cam shaft extending from the other end face of the disc into a bearing, while the grooved end face of the disc is completely free and has extending thereacross the stem of a poppet, the position of the stem being such that its centre line intersects the axis of rotation of the disc at right angles. A sleeve is situated for free sliding motion on the stem and constitutes the said lost motion member. Two abutments, a lifting and a return abutment, are provided on the stem to limit the axial movement of the sleeve, and a relatively short compression spring is situated between the sleeve and the return abutment and urges the sleeve against the lifting abutment. The abutments conveniently comprise two shoulders disposed face to face on the stem. A pin, secured to the side of the sleeve, extends parallel to the axis of the disc and into the groove and has pivotally seated thereon a cam follower adapted to slide in the groove in working contact with the cam faces. The follower is so shaped that the face contacting the internal cam has a curvature equal to the most acute part of the curvature of that cam; this enables the follower to make area contact with the internal cam in a position of the working cycle when the pressure on the follower is high, and thus good wearing conditions are provided for the follower and the cam. The mechanism, that is the disc, the sleeve and the relevant part of the stem, is enclosed by a housing formed on the cylinder head adjacent the inlet or outlet duct, as the case may be, of the engine. The stem extends from the head of the poppet through the inlet or outlet duct and into the housing, a slide bearing for the stem being provided in the wall between the housing and the duct. That wall of the housing which faces the disc is provided with a straight groove embracing the exterior of the said sleeve to support it against the transverse forces imparted to it by the cams when in operation. The said cam shaft is geared to the crank shaft of the engine in accordance with usual practice.

The cams are so dimensioned that the return stroke, imparted by them to the sleeve, is slightly longer than the return stroke of the poppet, the return stroke of the latter being limited by the valve seating.

In operation, during the lifting period, the movement of the cams is transmitted by the sleeve to the stem by way of the lifting abutment. During the return stroke, the sleeve acts on the return abutment through the said spring. When the poppet is seated at the end of its return stroke, the sleeve continues to move in the return direction, coming away from the lifting abutment and compressing the spring. As soon as the sleeve commences its lifting stroke, it approaches the said lifting abutment again, and contacting the latter, starts the lifting stroke of the poppet.

In a modification, a double-ended lever or rocker is interposed between the disc and the sleeve, one end of the rocker supporting the cam follower, while the other end of the rocker engages the sleeve or any other lost motion means that may be provided. This arrangement does not require the grooved face of the disc to be entirely free, and the cam shaft may extend right through the disc. This enables a plurality of cam discs to be mounted on a common cam shaft such as would be desirable, for example, for an engine having two or more parallel cylinders situated in a common plane.

MEWBURN, ELLIS & CO.,
70-72 Chancery Lane, London, W.C.2,
Chartered Patent Agents.

Abingdon: Printed for Her Majesty's Stationery Office, by Burgess & Son (Abingdon), Ltd.—1955.
Published at The Patent Office, 25, Southampton Buildings, London, W.C.2,
from which copies may be obtained.

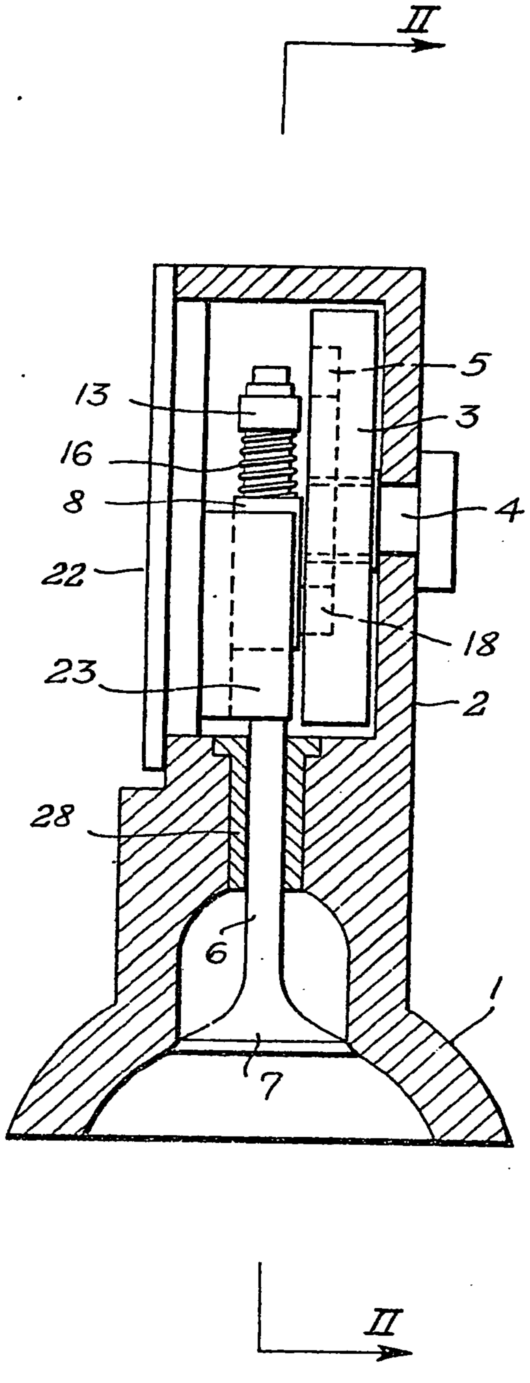


FIG. 1

FIG. 2

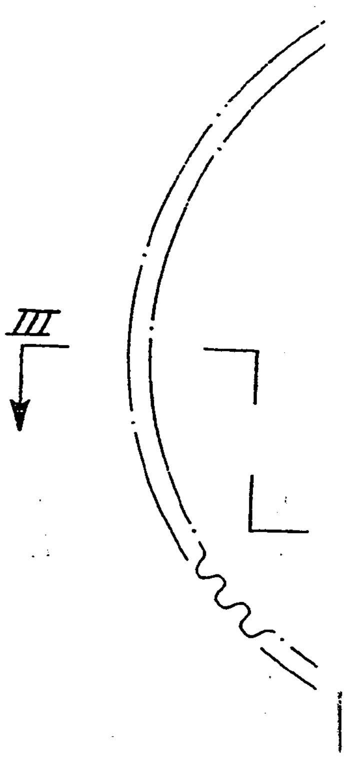
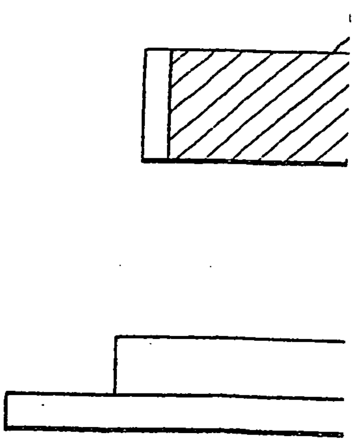


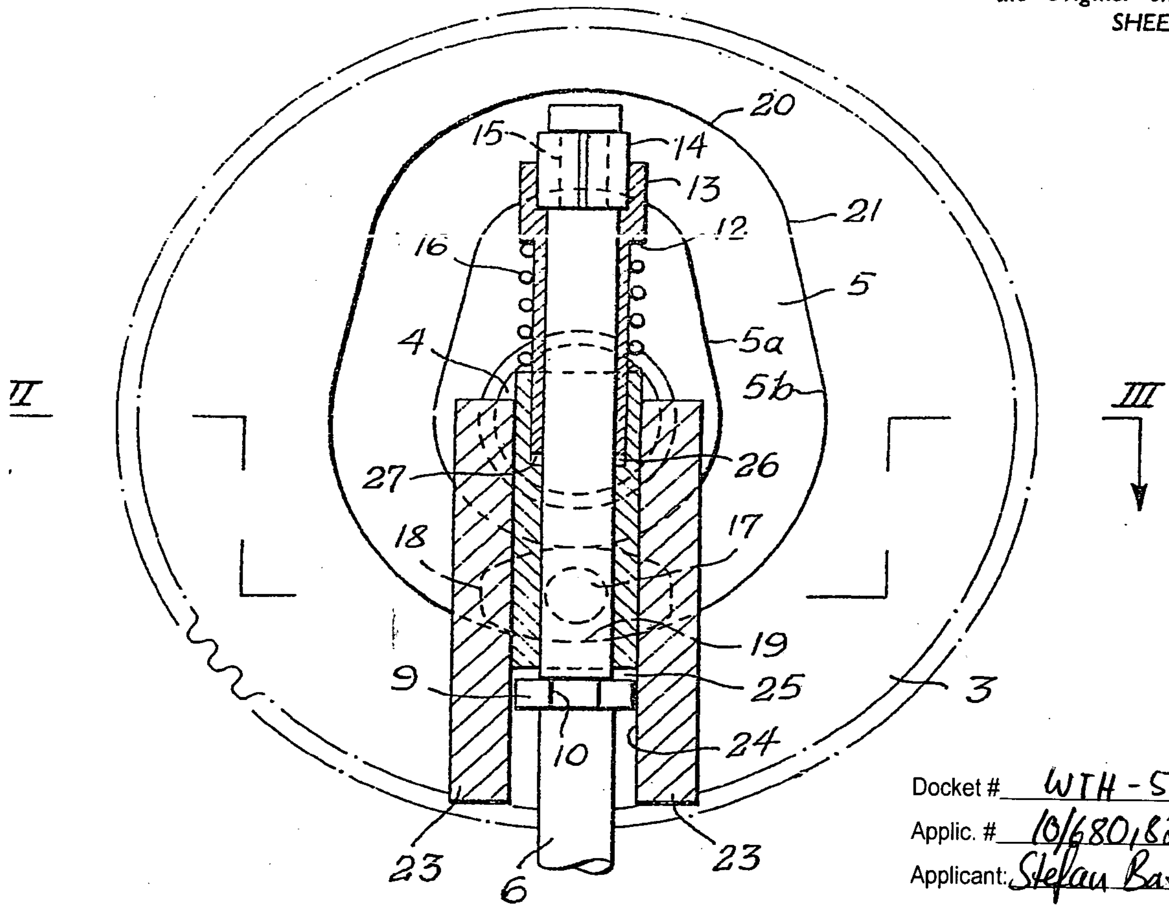
FIG. 3



741,831 COMPLETE SPECIFICATION
2 SHEETS

This drawing is a reproduction of the Original on a reduced scale.
SHEETS 1 & 2

FIG. 2



Docket # WTH-53962-25
Applic. # 10/680,821
Applicant: Stefan Battlogg
Lerner and Greenberg, P.A.
Post Office Box 2480
Hollywood, FL 33022-2480
Tel: (954) 925-1100 Fax: (954) 925-1101

FIG. 3